SCIENCE

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FRIDAY, AUGUST 4, 1899.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

DOCTORATES CONFERRED BY AMERICAN UNIVERSITIES.

WE are able to give again this year from official sources certain statistics in regard to the degree of Doctor of Philosophy, together with the names of those who have received it in the sciences and the titles of their theses. It appears from the following table that the doctorate has been conferred by twenty-three universities on 224 candidates.

Universities.	Humanities.	History and Economics.	Sciences.	Total.	Compared with 1889.
Johns Hopkins	13	8	17	38	+ 5
Columbia	4	6	23	33	+ 9
Yale	11	4	15	30	− 4
Chicago	7	4	13	24	− 12
Harvard	13	4	7	24	− 2
Pennsylvania	7	5	8	20	− 4
New York	8	0	1	9	+ 4
Cornell	3	2	2	7	− 12
Wisconsin	0	3	4	7	+ 2
Clark	0	0	5	5	− 7
Michigan	1	0	3	4	− 3
California	0	0	3	3	+ 2
Brown	3	0	0	3	+ 2
Bryn Mawr	1	0	2	3	0
Princeton	0	0	3	3	+ 2
Minnesota	0	1	1	2	+ 1
Virginia	0	0	2	2	+ 2
Washington	0	0	2	2	+ 2
Colorado	0	0	1	1	+ 1
Kansas	0	0	1	1	+ 1
Missouri	0	0	1	1	+ 1
Nebraska	0	0	1	1	− 1
Syracuse	1	0	0	1	+ 1
Total	72	37	115	224	.....
Compared with 1898..	− 19	− 1	+ 10	.....	− 10

The table gives a comparison with the data for last year which shows a decrease of ten in the total number of degrees conferred. This is doubtless an accidental variation without significance. The decrease of nineteen degrees in the humanities, under which are included philology, grammar, literature and philosophy, may also be accidental, but the comparatively small number of university doctorates in these subjects deserves consideration. Our educational system is largely based on the study of language, and in view of the great number of teachers required it appears that they are satisfied with a less adequate education than is the case in the sciences. In Germany every gymnasium teacher of Latin or French holds the equivalent of a doctorate, and there is evidently need of a higher standard in America. This year education and sociology have been placed with the sciences. Philology and economics are, of course, also sciences. The division is artificial and made only in respect to the general field covered by this JOURNAL.

Six universities, Johns Hopkins, Columbia, Yale, Chicago, Harvard and Pennsylvania, conferred 169 degrees—more than three times as many as all the other universities combined. Columbia gave this year decidedly the largest number of degrees in the sciences, while Harvard is the only one of these universities in which the degrees in the humanities were more numerous than in the sciences. The degree was not conferred last year by Indiana, Illinois, Stanford, Cincinnati, Columbian, Catholic, Western Reserve, Vanderbilt, or Tulane University. The degrees were in all cases the doctorate of philosophy, with the exception of two doctorates of science, one at Harvard and one at New York University.

The distribution of students among the different sciences was as follows:

Chemistry	32	+5
Psychology	15	−3
Mathematics	13	+2
Botany	11	0
Zoology	11	−1
Physics	7	−4
Education	5	
Geology	5	−1
Sociology	5	4
Paleontology	4	+4
Astronomy	2	−1
Mineralogy	2	+2
Physiology	1	−3
Bacteriology	1	+1
Meteorology	1	+1

The second column, giving the increase or decrease as compared with last year, indicates that the sciences have in general maintained the same relative position. Chemistry leads so decidedly because in this science a university training is useful in technical work. The most disappointing aspect of university education seems to be the complete lack of medical students who take higher degrees. Here we have a field for research sure to yield results of the greatest possible theoretical and practical importance, and but very few trained workers. Physicians have opportunity, and in most cases leisure, but owing, it appears, to the lack of a proper education they accomplish comparatively little in the way of scientific research.

While no definite conclusion can be drawn from the results of a single year, it may be noted that at Johns Hopkins more than half the scientific degrees are given in chemistry. This science also leads at Yale and Harvard. Psychology and education are especially strong at Columbia. Chicago stands first in zoology and in physiology.

The details in regard to the theses are as follows:

COLUMBIA UNIVERSITY.

Burtis Burr Breese: Inhibition.

Edward Sandford Burgess: Studies in the Genus Aster.

Elsie Worthington Clews: The Educational Legislation and Administration of the Colonial Governments.

Henry Edward Crampton, Jr.: The Early History of the Egg in Molgula Manhattensis.

George Van Ness Dearborn: The Emotion of Joy.

Edwin Grant Dexter: Conduct and the Weather.

Elmer Wallace Firth: Micro-organisms in the Air of Public Buildings and Conveyances, due to Improper Methods of Cleaning.

Shepherd Ivory Franz: After-Images.

George Balthasar Germann: National Legislation concerning Education: Its Influence and Effect in the Public Land States East of the Mississippi.

Frederick Smith Hall: Sympathetic Strikes and Sympathetic Lockouts.

John Duer Irving: Some Eruptive Rocks of the Northern Black Hills and their associated Ore-bodies.

Smith Ely Jelliffe: The Flora of Long Island.

Edward Kasner: The Invariant Theory of the Inversion Group.

Walter Coluzzi Kretz: Positions and Proper Motions of the Principal Stars of the Cluster in Coma Berenices as deduced from Measurements of the Rutherfurd Photographs.

James Howard McGregor: Spermatogenesis in Amphiuma.

James Maclay: Double Minimal Surfaces whose Minimal Curves have Two Points on the Infinitely Distant Circle.

John Francis Woodhull: The Teaching of Physics in Secondary Schools.

Frederick John Pope: Investigation of Magnetic Iron Ores from Eastern Ontario.

George Albert Soper: The Purification of Drinking Water by the Use of Ozone.

Adna Ferrin Weber: The Growth of Cities in the Nineteenth Century.

Theodore Greely White: The Black River, Trenton, and Utica Formations in the Champlain Valley of New York and Vermont.

Harriet Winfield: The Oil of Maize.

Robert Sessions Woodworth: Psychology, The Accuracy of Voluntary Movement.

THE JOHNS HOPKINS UNIVERSITY.

Edward William Berger: Zoology, The Cubomedusæ, Physiological and Histological.

William Noland Berkeley: Chemistry, An Investigation of the Relative Rate of Reduction of Nitrobenzoic Acids.

Horace Greeley Byers: Chemistry, A Study of the Reduction of Permanganic Acid by Manganese Dioxide.

Joseph Scudder Chamberlain: Chemistry, A Further Study of two of the Products of Transformation of Parasulphaminebenzoic Acid when heated to 220°.

Francis Whittemore Cragin: Geology, The Paleontology of the Malone Jurassic Formation of Texas.

Oliver Lanard Fassig: Geology, March Weather in the United States, with special reference to the Middle Atlantic States: A Study of the Relations existing between Mean Atmospheric Pressure and the General Characteristics of the Weather and Storms in March.

George Stronach Fraps: Chemistry, The Composition of a Wood Oil.

Leonidas Chalmers Glenn: Geology, A Contribution to the Study of the Pelecypoda of the Miocene of Maryland.

Caswell Grave: Zoology, Ophiura Brevispina, Say.

Willis Boit Holmes: Chemistry, A Further Investigation of the Chlorides of Orthosulphobenzoic Acid and Paranitroorthosulphobenzoic Acid.

George Oscar James: Mathematics, On the Differential Equations connected with Hypersurfaces.

Joseph Francis Merrill: Physics, Influence of the surrounding Dielectric on the Conductivity of Copper Wires.

Rokuro Nakaseko: Chemistry, Some Transformations of Metasulphaminebenzoic Acid under the Influence of Heat.

Frederick Albert Saunders: Physics, A Bolometric Study of the Spectrum of an Absolutely Black Body between the Temperatures of 100° and 578° Centigrade.

Harold John Turner: Chemistry, Reaction of Sulphourea with Benzene- and Toluene-sulphon Chlorides.

Campbell Easter Waters: Chemistry, A Study of the Products formed by the Action of Heat on Parasulphaminemetatoluic Acid.

Francis Daniel Wilson: Chemistry, I. Orthosulphaminebenzoic Acid; II. Orthocarbaminebenzenesulphonic Acid.

James Henry Curry Winston: Chemistry, Action of Tetrazoditolyl Chloride and Tetrazodiphenyl Chloride on Certain Alcohols.

YALE UNIVERSITY.

Lee DeForest: Reflection of Electric Waves of very high frequencies at the ends of Parallel Wires.

Alexander William Evans: The Hawaiian Jubuloideæ, a Tribe of Hepaticæ.

Arthur Woolsey Ewell: Rotatory Polarization of Light in Media subjected to Torsion.

Herbert Ernest Gregory: Geology of the Aroostock Volcanic Area of Maine.

Franke Stuart Havens: Analytical Separations by Hydrochloric Acid.

Holmes Condict Jackson: Some Observations on the Carbohydrates of the Liver.

William Smythe Johnson: Researches in Practice and Habit.

Louis Cleveland Jones: The Estimation of Boric Acid.

Edward Martin Kindle: The Devonian and Lower Carboniferous Faunas of Southern Indiana and Central Kentucky.

Albert Galloway Keller: A Sociological Study of the Iliad and the Odyssey.

Matataro Matsumoto: Researches on Acoustic Space.

William Conger Morgan: The Stereochemistry of Nitrogen.

William Huntington Parker: 1. A Study of the Alloxuric Bases, with especial reference to their Origin in the Intestine; 2. On the Maximum Production of Hippuric Acid in Rabbits.

Leona May Peirce: On Chain-Differentiants of a Ternary Quantic.

Charles Hyde Warren: Investigations in Mineralogy and Crystallography, including a Description of four new Minerals from Franklin, N. J.

CHICAGO UNIVERSITY.

Frank Burnett Dains: On the Isourea Ethers and other Derivatives of Ureas.

Emily Ray Gregory: Vertebrate Embryology.

Wesley Walker Norman: The Reaction of Lower Animals upon Injuries and the Theory of Pain Sensations.

Wilson Robert Smith: A Contribution to the Life History of Isoetes.

Aaron Louis Treadwell: The Cytogeny of Podarke.

Elizabeth Jefferies: On Methanes.

William Clark Gordon: The Social Idea of Tennyson as related to his Time.

Charles Abram Ellwood: Some Prolegomena to Social Psychology.

Henry Gordon Gale: On the Relation between Density and Index of Refractions in Gases.

Irving Hardesty: The Number and Arrangement of the Fibers forming the Spinal Nerves of the Frog.

John Anthony Miller: Concerning certain Elliptic Modular Functions of Square Rank.

Nels Lawrence T. Nelson: Revision of the North American Species of *Solanum*.

James Harvey Ransom: Molecular Rearrangement of O-Animophenol Derivatives.

UNIVERSITY OF PENNSYLVANIA.

Oliver Perry Cornman: Psychology, Spelling, a Psycho-pedagogical Study.

John Brookie Faught: Mathematics, Certain Development Coefficients analogous to Bernouilli's Numbers.

Paul Renno Heyl: Mathematics, The Theory of Light on the Hypothesis of a Fourth Dimension.

Joseph Hidy James: Chemistry, An Electrolytic Study of Benzoin and Benzil.

Lily Gavit Kollock: Chemistry, Electrolytic Determinations and Separations.

Charles Dickens Nason: Pedagogy, The Schools of the Society for the Propagation of Christian Knowledge among the Germans of Pennsylvania.

Richard Conrad Schiedt: Zoology, Some Phenomena of Pigmentation.

Alfred Tingle: Chemistry, The Influence of Substituents upon the Electric Conductivity of Benzoic Acid.

HARVARD UNIVERSITY.

Gregory Paul Baxter: Chemistry, A Revision of the Atomic Weight of Cobalt.

Edward Charles Jeffrey: Botany, The Development, Structure, and Affinities of the Genus Equisetum.

Gilbert Newton Lewis: Chemistry, A General Equation for Free Energy and Physico-Chemical Equilibrium, and its Application.

Arthur Henry Pierce: Psychology, The Localization of Sound.

John Percival Sylvester: Chemistry, Some Sulphuramido Derivatives of Furfuran.

Edwin Mead Wilcox: Botany, Contributions to the Knowledge of Dormancy in Plants.

Justus Watson Folsom: Zoology, Studies upon the Mouthparts of Apterygota.

CLARK UNIVERSITY.

James W. Boyce: Mathematics, On the Steinerian Curve.

Henry H. Goddard: Psychology, The Influence of Mind on Body.

Edmund B. Huey: Psychology, Physiology and Psychology of Reading.

George E. Partridge: Psychology, The Psychology of the Intoxication Impulse.

Henry D. Sheldon: Psychology, The History and Pedagogy of American Student Societies.

UNIVERSITY OF WISCONSIN.

A. T. Lincoln: Chemistry.

W. B. Lane: Psychology.

J. C. Shedd: Physics.

Theo. Running: Mathematics.

UNIVERSITY OF CALIFORNIA.

George Davis Louderback: On the Origin of the Glaucophane and associated Schists of the Coast Ranges. A contribution to the theory of the Crystalline Schists.

Winthrop John Van Leuven Osterhout: Observations on Spindle-formation and Chromosome-reduction in Plants.

Milicent Washburn Shinn: A Study of the Development of Sense Activity in the first three years of Childhood, with Pedagogical Conclusions.

UNIVERSITY OF MICHIGAN.

John Black Johnston: Zoology, The Structure of the Brain of Acipenser Rubicundus.

Paul Ingold Murrill: Chemistry, Halides and Perhalides of the Picolines.

Edwin DeBarr: Chemistry, The Decomposition of Alpha, Beta, and Gamma, Halogen-substituted Acids by Water.

PRINCETON UNIVERSITY.

William Foster, Jr.: Chemistry, The Conductivity and Dissociation of some Electrolytes.

Stanley Chester Reese: Astronomy, The Jupiter Perturbations of Minor Plant 367, with an ephemeris.

Alexander Hamilton Phillips: Mineralogy, The Geological and Mineralogical Characteristics of the Rocky Hill Trap.

BRYN MAWR COLLEGE.

Helen Dean King: Morphology, The Maturation and Fertilization of the egg of Bufo Lentiginosus.

Emilie Norton Martin: Mathematics; Determination of the Non-primitive Substitution Groups of Degree Fifteen and of the Primitive Substitution Groups of Degree Eighteen.

CORNELL UNIVERSITY.

Patrick Beveridge Kennedy: The Fruits of Grasses, with Reference to their Structure, Morphology and Taxonomy.

Darwin Abbot Morton: Anethol and its Isomers.

UNIVERSITY OF VIRGINIA.

Hillary L. Roberts: Mathematics, On the Geometry of a certain Group of Transformations.

John E. Williams: On the Geometry of a certain Group of Transformations.

WASHINGTON UNIVERSITY.

Hermann von Schrenk: Botany, A Disease of Taxodium known as Peckiness, also a Similar Disease of Libocedrus Decurrens.

Louis Herman Pammel: Botany, Anatomical Characters of the seeds of Leguminosæ, Chiefly Genera of Gray's Manual.

UNIVERSITY OF COLORADO.

Arthur John Fynn: Pedagogy, The Pueblo Indian as a Product of Environment.

UNIVERSITY OF MINNESOTA.

Alice J. Mott: The tenth year of a deaf child's life.

UNIVERSITY OF KANSAS.

Joshua W. Beede: Paleontology.

UNIVERSITY OF MISSOURI.

Chas. Thom: Botany, Morphology and Physiology of Reproductive Organs in the Archegoniatæ.

UNIVERSITY OF NEBRASKA.

Carl Christian Engberg: 1, The Cartesian Oval; 2, An Extension in the Theory of the Characteristics of Evolutes.

NEW YORK UNIVERSITY.

William C. Alpero: The Oils and Terpenes of Arabia Indicautis.

THE INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE.

IN a recent number of SCIENCE, Professor Carus has presented most serious objections to the bibliographical methods proposed by the Royal Society's Committee. For the professional zoologist such a verdict needs no criticism. For no one else can possibly claim to have such a wealth of experience at his disposal as this Nestor of scientific bibliography.

Severe as the criticisms of Professor Carus are, they may be supplemented by others which will make the case against the proposed schedules still stronger. Book bibliographies may entirely dispense with arbitrary symbols; the real test of a numerical system is to be sought in the application of the system to cards. Since I have been the pioneer in the publication of an extensive card catalogue of scientific literature, it was natural that the editors of SCIENCE should invite me to express in their columns a judgment upon the new proposals; but my criticisms, if frankly expressed, would have to be so severe that I was loath to take a position which would seem to place me in opposition to an enterprise to which I had already pledged allegiance. I feel, however, that I cannot withhold the following statement:

No one without extensive experience can possibly foresee the complications that arise

in practice; nor can the matter be easily explained. A simple statement may, however, serve as an illustration. Thus far the Concilium Bibliographicum has issued more than 3,000,000 cards. During the past year we made a trifling modification in the typography, which surely passed unnoticed by nearly all our subscribers. This discovery leads to a minute saving on each card, but in view of the enormous number of cards the saving is great enough to modify considerably the balance sheet.

I have given the schedules proposed by the Royal Society's Committee a fair trial, with more than 3,000 different zoological cards. Indeed, I have worked so much with this classification that I once knew it quite by heart. It is my firm conviction that our organization would have long since failed utterly had we been obliged to use it for our work. It is also significant that the faults of the new schedules are merely exaggerations of those that I should have made when I first began working out the details of our own undertaking. I have recently passed in review some of my own notes, dating from February, 1894, and I am surprised to see there the same insufficiencies in what I then considered a completely adequate plan.

It is difficult to criticise, in the definite way that one would desire, a work which probably scarcely a dozen of the readers of SCIENCE can ever have seen. For this reason I shall refer rather to a Memorandum published by the Committee subsequent to Professor Carus's article, and which is intended to justify the course followed. In one respect this Memorandum resembles its predecessors in a way that is most regrettable. It is that of ignoring all that others have done or said in regard to the matter under consideration. Professor Carus had brought direct, definite and undeniable charges of insufficiency against the schedules of the Committee. Not one of these charges has been answered nor even alluded to. Surely this refusal to accept debate and the avoidance of publicity cannot be indefinitely maintained. The scientific world has the right to know why no account is to be taken of the opinions of those best qualified to judge of the merits of the case.

The methods of those who use the decimal system are condemned in this Memorandum with a few words, which I shall transcribe: "The Committee prefers to designate the sciences by letters rather than by numbers." In my opinion, this is a small matter; it is a mere matter of convention, like signals at sea. Uniformity alone is essential. The Concilium Bibliographicum will soon have 5,000,000 cards where a number is used for this purpose; this number is the same that is used for the same division in all libraries using the decimal system; it also corresponds with the numbers used for 2,500,000 different cards in Brussels, and with a larger collection in Paris. Such use has been advocated by the French Association for the Advancement of Science, by the Société de Biologie, by the Société Zoologique, by the corresponding Swiss organizations and by numerous Italian and Belgian societies. Indeed, the Decimal Classification has had a marvellous development. Unknown in Europe a few years ago, it has spread over the whole of Europe; it has been carried to Australia and to South America; indeed, I recently heard of an application that was being made of it in Japan and another in Hawaii. It has not, of course, yet gained the confidence of the majority of bibliographers. That would be too much to expect of it, but we may be assured that a short experience with *cards* would convince even those now opposed. In the future, if the will of the Committee prevails, two systems will struggle for mastery. The new symbols can only be introduced by destroying the accord that has already been attained. In a word, in 'preferring' to

use letters rather than numbers, the Committee calls upon the scientific world to aid it in crushing out the work that has already been done. For this it must have weighty reasons, or it would be wrong for any government to favor such action.

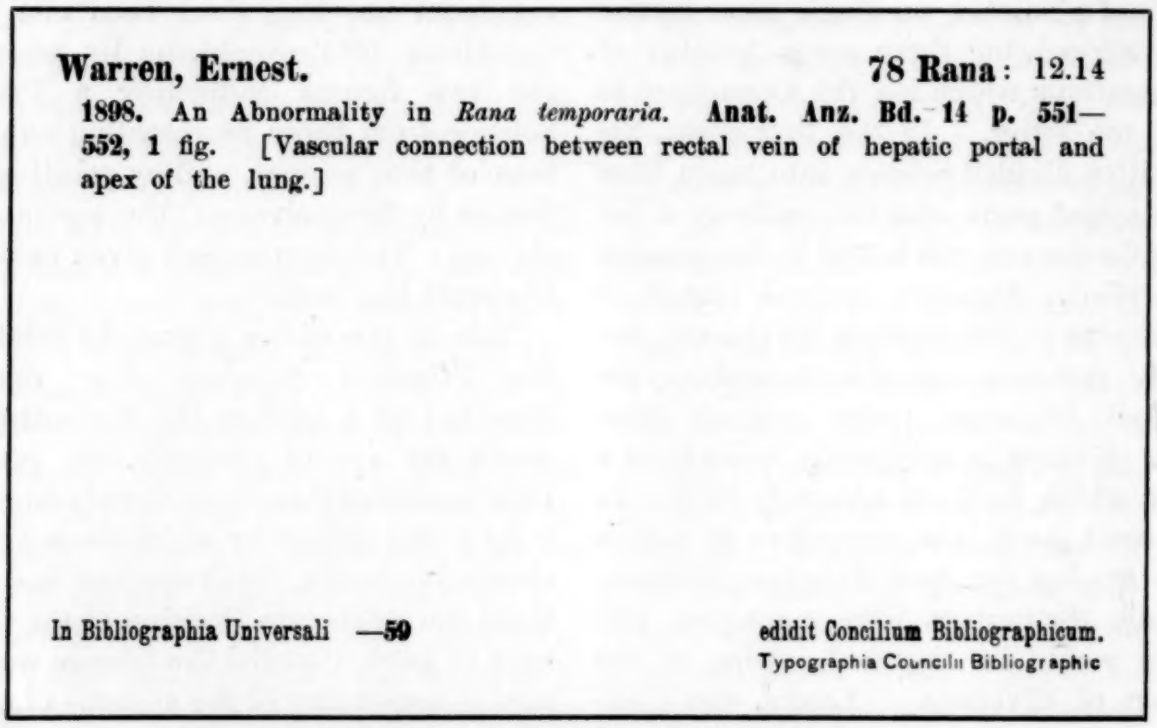
The Committee writes: "As between a letter and a number no single final reason can be alleged, but there are a number of considerations which led the Committee to prefer the letter. In the first place, the Committee divided Science into more than two principal parts, and the tendency of the recent Conference was to add to the number of divisions. Hence a decimal system is inapplicable to the Primary Divisions, unless by grouping together several of the Principal Divisions under one or more heads. Science is arbitrarily made to fit a system which does not naturally fit it. In the second place, it is convenient to have a single symbol for each Principal Science, whereas, if numbers were employed, two figures would be required, owing to the number of divisions. Lastly, the Committee believe that fewer mistakes would be made in sorting the slips and cards if attention had to be paid to a letter and number rather than to a single but longer number. On the whole, then, the Committee, decided to represent the Principal Sciences by arbitrary letters."

These are the arguments, but I refuse to believe that it will be generally felt that they justify the work of destruction which is proposed. But even the little weight these arguments may seem to have disappears when they are closely examined. The letters required for the sciences thus far selected for treatment run from A to R, thus permitting for the time being, it is true, the use of a single symbol; but it is evident that this is possible simply because the proposed catalogue is to contain only certain sciences. Professor Carus has already pointed out the dangers of thus disregarding a general system of notation compatible with the adjunction of new branches. With the addition of a few subjects, the 26 letters of the alphabet will be exhausted, just as the ten digits would be. This eventuality destroys the whole value of the first two arguments. The difficulty contemplated in the third argument has long since been met in the Concilium Bibliographicum by separating the two figures indicating a Principal Science from those representing sub-divisions of that science, and by printing these figures by themselves as 'the signature' of the set. The sample card given below will illustrate this feature.

This is the entire argument relating to the Principal Sciences. For the subdivisions of a science the Committee proposed the use of numbers, but preferred other numbers than those already employed. "As to the system by which these numbers should be chosen, the Committee had before them the deliberate decision of the Conference of 1896, that the Conference was 'unable to accept any of the systems of classification recently proposed,' among which the decimal system was, of course, included. This system had, therefore, not been accepted, and the Committee agreed, after further discussion, that it was not desirable again in any way to propose a decimal system. Such a system is open to two objections. In the first place, it assumes that each subject is to be divided into not more than ten divisions, each of which may be divided into not more than ten, and so on. This arbitrary use of the number ten is in practice extremely inconvenient, since it has no relation to the rational divisions of the sciences; and, in so far as it assumes that the subjects indicated by the figures in a certain place of decimals are subordinate to those which occur in a higher place, it involves theoretical considerations, the validity of which may not in all cases be admitted in the future. In the second

place, the decimal system is quite inapplicable to sciences which need a double system of registration, such as Geology (in which reference has to be made both to the order of the strata and to their geographical distribution), Geography, Zoology and Botany.''

about is dealt with under 242, or whatever the number may be, and under that number he finds the desired cards. When I turn to a time-table to learn when a train leaves I do not need to study out why that train leaves when it does rather than ten minutes later or earlier. The time-table satisfies me



Warren, Ernest. **78 Rana**: 12.14

1898. An Abnormality in *Rana temporaria.* **Anat. Anz. Bd. 14 p. 551—552, 1** fig. [Vascular connection between rectal vein of hepatic portal and apex of the lung.]

In Bibliographia Universali —59

edidit Concilium Bibliographicum.
Typographia Concilii Bibliographic

Specimen Card of the Concilium Bibliographicum.

The first of these objections seems again insufficient to justify the destructive and revolutionary measures proposed. On critical examination, indeed, it proves itself utterly groundless, being based upon a complete misconception of the decimal system as applied to a purely practical problem. This system does not attempt to force science into an artificial mould. It merely assigns an arbitrary number to each topic, so that the cards, when arranged according to these numbers, fall into their proper places. These numbers are so chosen that the framers of the system can expand it *ad libitum*, without ever altering the signification of the numbers previously used. How this latter feature can be reached the user of the catalogue does not need to know. He merely finds in the key that the topic he desires information

if I can find out when my train leaves. So it is with the Decimal System; one word of frank criticism, one single instance in which by its use one would be prevented from finding the answer to a question of bibliography would have more value than these theoretical considerations of coordination and subordination, which have nothing to do with the case. The best proof, however, that the Committee's argument is not serious is the fact that in framing the new schedules, in spite of the entire freedom of action that was enjoyed, the Committee involuntarily built up a decimal system, a new one, for all sciences save Chemistry and Mathematics, and even here the deviations from a decimal arrangement are not greater than Dewey himself allows. A new decimal system has been created, the numbers being

lengthened to four places, so as to remove the outward form of a decimal system; but, from want of experience in such matters, numerous pitfalls have not been avoided.

The second objection contained in the Committee's statements is one of extreme gravity; but it is a mere assertion, which a single glance at the Bibliography of the Concilium Bibliographicum would show to be utterly false. The Committee asserts that the decimal system is 'quite inapplicable' to sciences which need a double system of registration, such as Geology, Zoology, etc. It is well known, however, that the system is being applied to Zoology by Professor Carus, by myself and by others with entire success. Indeed, were I to select a single feature to show the paramount superiority of the decimal system it would be this facility of double registration. The Swiss Zoological Society voted warm approval of this method. The Executive Committee of the Swiss Society, corresponding to the British and American Associations for the Advancement of Science, was convened to a special session for the sole purpose of arriving at a definite conclusion as to the merits of this system. The Committee examined carefully the work of the Concilium Bibliographicum and pronounced the system vastly superior to that proposed by the Royal Society, and petitioned the federal government to oppose the proposed modification. A technical commission consulted by the federal authorities expressed the same opinion, as did also the Swiss Library Committee and the delegates appointed to attend the London Conference. This all took place after the government felt that it was committed to supporting the scheme of the Royal Society. Finally, a last conference was held under the presidency of the Minister of Interior and voted unanimously to make the adhesion of Switzerland absolutely dependent upon the decimal system being adopted. Such testimony from those who know the working of the system best is surely worth more than a simple assertion to the contrary by persons who evidently do not know the system condemned. Not merely is there abundant internal evidence that the statements made by the Committee must have been made in ignorance of the methods which it so severely condemns, but it can be proved by the books of the Concilium that they could not have studied the matter by examining our cards. Not merely has the Royal Society never subscribed to the cards issued by the Concilium, but there is only a single subscriber in all England who receives a set of cards sufficiently complete for it to be regarded as a fair sample. This subscriber has written that he is greatly impressed with the success of the methods followed by the Concilium, especially in the matter of the double system of registration. He states that the cards have never been examined by anyone connected with the Royal Society's undertaking. There is evidence, therefore, that this condemnation has been passed without knowledge of the thing condemned, for a final judgment with regard to the merits of such a bibliographical system cannot be reached, save by knowing it in its application to cards

Having met all the objections raised against the decimal system, I shall now say a word on the system which is proposed to replace it. Having, as already stated, tried this latter on several thousand cards, I can state, without fear of contradiction, that it fails utterly, as far at least as Zoology is concerned.

The zoological schedule proposed by the Royal Societies comprises two distinct parts, each designated by 2 figures. One part consists of what we should term the systematic classification and comprises 33 heads designated by the series of even numbers from 2 (or 02, as this is written, so as always to have two figures) to 66. The other

part, or topical classification, comprises 9 heads designated by odd numbers extending from 3 (or 03) to 35, the numbers 05, 09, 13, 17, 21, 15, 29 and 33 being left vacant. The entire symbol consists of four figures, the first two being taken from the systematic, the latter two from the topical classification.

The Committee states: "The numbers used to designate the subjects are scattered over a series extending from 203 [0,203] to 6,635 in such a way that any branch or any subject may be in future completely divided and numbers applied to the divisions without deranging the system previously in use." This statement shows clearly that the Committee not merely has failed to study the decimal system, which they condemn; but has not even examined critically their own system; for I believe that every attentive reader has already detected, in the course of my brief exposition, that no modifications nor interpolations are possible, for the simple reason that all the numbers are occupied. There are, it is true, eight vacant numbers, but these are, indeed, 'scattered,' so that no new sub-divisions can be introduced, for at least 2 places are needed to sub-divide. How necessary new divisions are may be gathered from the fact that one single division 0,407 would receive according to our experience, about 2,000 cards, annually. In ten years there would be twenty Library Bureau drawers filled with cards, all with the some identical symbol. No one, of course, consults a bibliography to know what has been published in regard to the Morphology of Vertebrates; he wishes to know what has appeared on the liver, the teeth, the skull; he desires information regarding Sphingidæ, not a rambling list of 8,000 papers on Lepidoptera (in 10 years there would be 8,000). We have at present on stock 400,000 cards dealing with Morphology (which is not sub-divided by the committee); several times a day we have occasion to seek out a relatively small number of cards from this great collection. Thus, if anyone desires to receive the cards relating to the liver 14 cards would be gathered together for him and he would be charged 14 cents, including postage and packing. The entire internal organization of the Bureau depends upon a precision of registration, such as an outsider can scarcely conceive to be necessary. Constantly one has to turn to the stock to replace a torn or soiled card, to return a duplicate to its place, or for some similar operation. Were we to try to use the Royal Society's schedules we should have to double our staff, and should even then live in a state of confusion that would be intolerable.

It seems astounding that the Committee should propose a system which admits of no modification, since Professor Armstrong stated at the first Conference that the "whole question resolves itself into whether we can adopt an inelastic system." But never was a system so inelastic as that proposed by the Committee. The Dewey System, the Cutter System and the Halle System may all be regarded as rivals. That of the Royal Society has not attained to this eminence, for it cannot claim to have even attempted to solve the initial problem, that of combining permanence with expansibility. Indeed, the Committee seriously proposes that their system might be revised and modified at intervals of five years! So far, then, from the great problem having been solved, it has not been even discovered what the nature of the problem is.

Quite as important as expansibility is the quality of *adaptability to special needs.* We have seen that the new schedules require that the systematic portion of the symbol should always be placed first. In other words, the symbols can not be adapted to the needs of those who wish to use topical divisions as their primary classification.

Thus a person interested in Cytology would be obliged to seek through all the groups of animals from Protozoa to Mammals in order to find the cards that he would require. It would have been extremely easy, with a little experience, to have arranged the *same divisions* so that the immense advantage which the Decimal System presents in this regard could have been obtained for the new schedules; but, here again, the Committee failed to grasp the problem, and consequently made no attempt to solve it. Nearly one-fourth of our subscribers require an arrangement which the Royal Society's schedules cannot give them. This is only one, however, of the special adaptations possible with the Decimal System. At present we have 7 such arrangements, each of which corresponds to certain definite needs. It is a significant fact that our arrangement, corresponding most closely to that absolutely prescribed by the Royal Society's schedules, has been offered for sale for two years and has found no subscribers.

Of course, a prime necessity in such a system of classification is that there should be a *place for everything*. It is also one of the most difficult features to attain. In elaborating the system employed in the Concilium Bibliographicum months were entirely devoted to studying the topics dealt with in the publications of a period of ten years, so as to properly proportion the divisions to the rate of publication and, above all, to be sure that no important topic was omitted. The after-trial showed that this had been done so successfully that there was little to add, the only serious omission being 'phosphorescence,' and this omission was due to an error in copying. A certain number of unusual topics do, indeed, appear each year which it is difficult to classify, as, for example, Ebner's papers on the electrical qualities of hair and feathers. On the other hand, scarcely a week passes when we do not meet with a dozen papers that the new schedules could not cope with, save, perhaps, by frequent repetition. What, for example, could be done with a lecture on Scientific Methods? Where would one classify a paper on the Advance of Natural Science during the Victorian Era? There is no place for Sir. Wm. Flower's book on museums, or rather there are many places for it. Then the science of microscopy with special text-books, with special journals, has no place assigned to it either as a primary science or as an aid to such sciences as Zoology or Botany.

In the choice of divisions the Committee has been not less unfortunate. For instance, there is a general division Arthropoda, but none for insects. A preliminary statistical study would have revealed to the framers of the tables that for every 20 papers appropriately placed under Arthropoda there are about 375 which deal exclusively with insects in general. One further instance may suffice. The Concilium Bibliographicum has experienced great difficulty with one of its divisions, namely, 07. This division, which is used for Museums, Laboratories, Stations, Technical Methods and Methods of Study, proves in practice utterly unwieldy. The diversity of these topics makes the search for a trifling matter a work of great labor. We had just begun to realize this when criticisms began coming in from our subscribers stating that they, too, found this group unwieldy. It was with interest, then, that I turned to the new schedules to see how the matter had there been treated. Far, however, from breaking up this division, the new schedules add to the diversified topics already mentioned the following special text-books and manuals: Relations to Plants; Injurious Animals; Special Products, Wax, Silk, Honey; Bibliographical, including Historical, Biographical. Could anything be less practical than this? It is, of course, no answer to state that it is proposed to use the system of

significant or predominant words for purposes of more minute sub-division. The Committee surely does not suppose that the sorting clerks and the libraries arranging the cards can attain, by significant words, a logical arrangement of the matter, such as is shown on the next to the last page of the zoological schedules, involving, as it does, the knowledge that the 'retina' goes with the sense organs, while 'Ears of Man and other Primaries' is a mere question of external facial morphology. The new system would, as we have seen, require a much larger staff of employees than would be necessary with the decimal system; this peculiar use of catch-words would make it, furthermore, necessary to employ trained zoologists for mere mechanical sorting. Moreover, I venture to state that the Committee would be astounded with the results of the simple experiment of classifying a few thousand cards, as proposed in the introduction to the zoological schedules. This matter is extremely difficult to explain in words, but the experiment is most convincing. It would be found notably that there would be a conflict between the systematic and the topical catch-words and that the bibliography would be rendered useless for a vast number of questions that it might otherwise answer.

Uniformity is regarded as no virtue by the Committee. This again proves how impossible it is for one to form a just *a priori* conception of the actual work in a Bureau publishing a card bibliography. In the tables of the Concilium, Embryology is treated somewhat differently in the zoological and in the anatomical bibliographies. This error was committed before the full value of uniformity had been grasped. It has proved to be a persistent source of confusion and delay. Indeed, such misconceptions abound in the report of the Committee. To cite one further example, the Committee speaks incidentally of sorting the cards into pigeon holes, as in a post-office. I, too, once believed that to be possible and blundered for many months before devising the multiple check system, which at once precludes errors of sorting and more than doubles the rapidity of the work.

It is not my purpose to discuss matters of *organization* in detail, but there are certain decisions in this regard that could not be passed over in silence. Regional bureaux organized by various countries are to prepare the manuscript, which is to be finally edited in London. Now a decision of the Congress says that the text, and not the titles, of the papers is to form the basis of classification. Therefore, one of two things must occur: Either the regional bureaux must maintain a fully competent staff of specialists, and themselves attend to the classifying, or the specialists in London must consult the works a second time, thus rendering the operations of the regional bureaus useless. The Concilium Bibliographicum follows strictly this principle of classifying according to the text and not to the title. I could cite papers which took many hours to classify, and numerous zoologists can bear evidence that we have not hesitated in cases of doubt to write to them personally before publishing. To show the constant difficulties, let me mention a few cases that have occurred *in the past week*: Firstly, we have had three papers describing new species, in which the fact that they were new could only be ascertained by the context, and one in which the symbol n. sp. was appended to a species already described elsewhere by the same author. Secondly, there is a paper by Alcock and Henderson, published in the *Annals and Magazine of Natural History* (7) Vol. 3, p. 1–27. In this paper 92 species are mentioned, of which 31 are new *and provided with new specific names.* There are, however, only 21 descriptions given. It is, furthermore, stated

that the figures will be given in connection with a work to be published, we believe, in India. Of all these facts memoranda were taken and a careful outlook was kept till this week, when an unexpected continuation appeared in the *Annals and Magazine* for April, where the remaining ten pieces were described three months after the first paper. We have still memoranda filed under the author's name and under publications arriving from India, so that the figures may be referred to in connection with the descriptions, and have written to the authors for more precise data. A third instance is in the last volume of the Mémoires of the Société Paléontologique Suisse. Here the new species are distinguished by the addition of the year 1898 to the author's name. In this case I do not believe an inexperienced person could discover that they were new species. Finally, in the last number of the Proceedings of the Zoological Society of of London, p. 586, is the description of a new species of monkey, contained in a statement of the additions to the menagerie. These are but a few instances taken from the proof-sheets now before me. Were I to go further back I might mention utterly confusing cases, such as the paper by Schuchert in the Proceedings of the United States National Museum, No. 1117, where the context shows that the new species described as *Dipeltis Carri* is really *Diplodiscus Carri*. Does the Royal Society really suppose that a reliable work can be framed, dependent upon the contributions of a score or more of workers scattered all over the globe? Does it suppose that all these countries will maintain a staff of trained specialists to do this work? In such work it is of prime importance that the work should be centralized; any other course is extravagant, leads to inaccuracies and confusion, and tends to delay the publication.

Turning, now, to the central bureau in London, let me point out a suggestive contrast: The Committee believe that, on the average, the experts editing the bibliography of each science will have about three or four hours' work per week. In the Concilium, although the experts lose almost no time for mechanically copying titles (this being done for them), it is found necessary to devote about 68 hours to this work. This does not include the time of the proof-reader.

The financial statement is also open to criticism. In the first place, it is to be noted that the estimates are based upon the use of the linotype, while all the examples involve ordinary type-setting. With the linotype only one kind of type can be used. In order to obtain a differential card, such as the Concilium issues, no less than six kinds of type, not to mention the Russian, Polish, Bohemian, Spanish, Hungarian, Scandanavian and Portuguese alphabets, which must frequently be drawn upon. Considering, now, the specimen set of slips, I may call attention to the fact that, according to the tariff in use on the Continent, at least, the type-setting would cost 35 per cent. more than it would according to our usages; the missing pages could not be estimated by the tariff, but the most favorable calculation for the Royal Society would make the expense three times as great as ours. When we turn, however, to the preparation of the secondary slips the expense becomes at least twelve times greater than that incurred by the Concilium. These facts are particularly significant, since the additional expense is primarily due to the non-adoption of the decimal system. That the sorting is thereby rendered much more expensive I have already shown. Finally, Professor Carus has pointed out the fact that the financial statement is based upon a great underestimate of the number of titles published. For Zoology the number should be tripled. The greatest discrepancy is to be found, however, in the estimated sale of the catalogue. For the authors' catalogue the Com-

mittee states that even under the most favorable circumstances 130 subscribers would be needed. The Concilium has seven subscribers to its authors' catalogue. Can it be that the Royal Society will be nearly twenty times as successful? For the 'complete catalogue' the Royal Society must find 286 subscribers. The Concilium has 18; but the price of its complete set is only about one-third that proposed by the Royal Society for the corresponding cards, and the bulk corresponding less. How many institutions will care to receive 90 or more cards a day, knowing that the entire expense will not fall far short of $500 a year?

To summarize, then, the project of the Royal Society can be shown to be utterly impractical, whether viewed from the technical side or from that of its finances. It has been elaborated by distinguished scientists, who have made the primordial error of supposing that experience was superfluous in dealing with such problems. It is a natural error to have made. It is one which I once also made without having the excuse of scientific eminence. I can frankly confess that 5 years ago my ideas on this subject were utterly immature and that it was my inexperience that made the first years of our work so unsuccessful. The Royal Society schedules might, of course, be applied to a book bibliography. Most of the objections which I have made would not exist, but *for the special needs of a card bibliography the zoological part is a complete failure and many other parts inspire grave objections.*

The most serious aspect of the case remains yet to be considered. The new enterprise is being organized without any consideration being taken of existing work. To succeed, the Royal Society must destroy all that exists, and it asks for a guarantee fund of $200,000, in addition to an annual expenditure in individual countries, which has been estimated at $20,000 as a minimum. The Committee, however, states that the work is to be regarded as an experiment and should be abandoned unless it should prove self-supporting. It will be evident to any one who has read attentively this note that the work can not be self-supporting if conducted as contemplated, and if given up nothing but devastation will have resulted from the action of the Royal Society. It was this perspective that caused Professor Carus to express the fervent wish that science might be spared this calamity.

Under such circumstances one may well ask one's self what should be the attitude of the Concilium Bibliographicum, which has been built up through thoroughgoing self-sacrifice. It was after the preparations for its foundation had been largely completed that the intentions of the Royal Society were first made known. Concerned lest the task that I had undertaken might be robbed of its utility by this greater enterprise, I applied for further information. No definite answer could be given, save the assurance that it was intended "to make use of all fitting existing institutions, certainly not to rival them." This answer was, however, regarded as sufficient by myself and my advisors, and it was decided to continue the work. Later a subsidy was granted to us with the distinct understanding that our mission was to be that of solving the technical difficulties involved in a great scientific card bibliography, and of forming a nucleus for the larger organization. It was thus that in our prospectus we freely pledged allegiance to the Royal Society's project, and our course has been uniformly directed to this end. To-day the conditions are strangely changed. The promoters of the new bibliography did not subscribe to the cards, nor has the slightest attempt been made to profit by our experience. The Concilium Bibliographicum has not been consulted regarding a single decision that has been taken. Indeed, the existence of an organization publishing one-third the

number of cards contemplated was not even alluded to in the Conferences, while the methods that have given such strikingly successful results have been condemned without consideration. In their place, methods similar to those which the Concilium tried and discarded are now proposed, and plans are elaborated that forebode a complete catastrophe. In the meantime, other organizations have tried methods similar to our own and have reached valuable results. So much has been done, indeed, and so much money and labor have been expended, that an abandonment of the work is out of the question. If the new bibliography rejects these methods there is no other course possible than for the governments that have been convinced of the value of these methods to maintain a second parallel bibliography. The decision of the Conference, held under the presidency of the Swiss Minister of Interior, is clear in this regard: It makes the participation of Switzerland definitely dependent upon the acceptation of these tried methods, and gives the government freedom of action in case its conditions are not accepted. For my part, I feel that I should belie the entire character of our enterprise were I to hold aloof from the Royal Society from motives of personal interest. But it seems equally certain that I should betray the trust that was given to me were I to consent, through motives of personal interest, to render useless the work which has been so zealously built up. We owe it to the world that the work of five years should not be labor in vain.

But what necessity exists for such drastic measures? We are still ready to rally under the banner of the Royal Society. The only condition is one that will preserve the Royal Society's undertaking from catastrophe.

HERBERT HAVILAND FIELD.

ZURICH.

*THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.**

I NEED hardly remind you that the Australasian Association held its first meeting in Sidney, from 27th August to 5th September, of the Centennial year, 1888, under the presidency of Mr. H. C. Russell, C.M.G., F.R.S., with a roll of 850 full members. Meetings have since been held in Melbourne in 1890, with 1,162 full members, when the late Baron von Mueller, K. C.M.G., F.R.S., M.D. and Ph.D., was President; at Christchurch, N. Z., in 1891—President, Sir James Hector, K.C.M.G., M.D., F.R.S.; at Hobart, in 1892—President, His Excellency Sir Robert Hamilton, K.C.B., LL.D.; at Adelaide, in 1893—President, Professor Ralph Tate, F.G.S., F.L.S.; and at Brisbane, in 1895, when the Hon. A. C. Gregory, C.M.G., M.L.C., F.R.G.S., was President.

The government of New South Wales provided for the printing of the first volume, and the governments of Victoria, Tasmania, New Zealand, South Australia and Queensland have each in turn given liberal assistance, both by money grants and in other ways towards the expenses of the session, and by printing the volume of reports and papers.

The Association has up to the present published 6 volumes of reports, each of about 1,000 pages, containing much important matter; it has appointed committees for the investigation of the following subjects; all have furnished reports, which, being of permanent value, have been printed, viz:

1. The Establishment and Endowment of a Biological Station for Australasia.
2. Certain points in the Construction and Hygienic Requirements of Places of Amusement in Sydney.
3. A Census of Australasian Minerals.
4. Glacial Evidence in Australasia, £20 granted towards the expenses.

* From the address of the President at the Seventh Meeting, held at Sydney, 1898.

5. Town Sanitation.

6. The Seismological Phenomena of Australasia, (£10 granted in aid of this research).

7. A Bibliography of the Australasian and Polynesian Races.

8. The Question of Antarctic Exploration.

9. The State and Progress of Chemical Science in Australia, with special reference to Gold and Silver Saving Appliances.

10. The Question of Rust in Wheat.

11. The Location and Laying-out of Towns.

12. The Improvement of Museums as a means of Popular Education.

13. The Fertilization of the Fig in the Australasian Colonies.

14. The Unification of Colors and Signs of Geological Maps.

15. The Tides of Australia (The Tides of the coast of South Australia).

16. Polynesian Bibliography, with special reference to Philology.

17. The Protection of Native Animals.

18. Glacial Action in Australasia during Tertiary and Post-tertiary Eras.

19. The Photographing of Geological Surveys.

20. The best means of encouraging Psychophysical and Psychometrical Investigation in Australia.

It has also granted the sum of £25 towards the ascertainment of movements of New Zealand glaciers, and £10 towards the cost of the erection at Timaru of the seismological instruments, presented by Dr. Von Rebeur-Paschwitz. It has secured (1) from the New Zealand Government the reservation of the Little Barrier Island, and Resolution Island, Dusky Sound, as suitable localities for the preservation of native flora and fauna. (2) In response to a recommendation from the 1891 session, it was agreed by the Lords of the Admiralty, that the sea between New Zealand, and the islands to the northwest of New Zealand, on the one hand, and Australia and Tasmania, on the other, be known as the Tasman Sea, and that the name is to be entered on the Admiralty charts. (3) Further, through the instrumentality of the Association, the New Zealand Government has set apart Stephen's Island, Cook Strait, as a reserve for the Tuatara Lizard, and (4) Correspondence has been received from the Governments of Tasmania, New South Wales, New Zealand and Victoria, in which sympathetic acknowledgment is expressed towards the wishes of the Association in regard to resolutions, passed at its last Session (in Brisbane), viz., to bring before the Australasian Governments that it is desirable:

a. That a system of compulsory notice of infectious diseases be introduced.

b. That a system of federal quarantine be introduced.

c. That stock, the milk or flesh of which is intended for consumption, be examined by duly qualified men, and slaughtered, if found tuberculous or cancerous.

At the last session (Brisbane, 1895) a number of research committees were appointed, some of which will report during the present session. Chief among these may be mentioned:

1. For the investigation of Glacial Deposits. (Reappointed.)

2. The Seismological Committee, to investigate earthquake phenomena in Australasia. (Reappointed.)

3. To consider and report upon the Thermo-dynamics of the Voltaic Cell.

4. The geology, land flora, land fauna, and natural resources of the islands and islets of the Great Barrier Reef.

5. The habits of the teredo, and the best means of preserving timber or structures subject to the action of tidal waters.

6. The Committee to give effect to the suggestions contained in Sir Samuel Griffith's paper entitled 'A Plea for the Study of the Unconscious Vital Processes in the Life of a Community.'

Australian Benefactions to Science.

In connection with the efforts made for the advancement of science in Australia we should not overlook the recent generous gift made by Mr. P. N. Russell of £50,000 for the support of our Engineering School, for instruction in pure and applied science. This is, perhaps, one of the best ways of supporting the objects of this Association, *i. e.*, by providing a scientific training for

students, who may develop into men of science.

Then there is the bequest made by Sir Thos. Elder to the Adelaide University, of which a large portion goes to support the mining and other scientific schools.

Also the scientific expedition to Central Australia, which was despatched by Mr. Horn from Adelaide at great expense. We shall have the pleasure of hearing of some of the results of this act of public-spirited generosity from Professor Spencer, who is kindly giving our members a lecture upon Central Australia.

Next there is the expedition from the Royal Society of London, under Professor Sollas, to investigate the structure of a coral reef by boring, to which this colony contributed liberally in men, money and material.

During the past year this has been supplemented by another expedition from Sydney under the charge of Professor David, largely at the cost of residents in this colony and the new South Wales Government. The Royal Society of London has again provided a large portion of the requisite funds.

I do not propose to go into the matter, as I have no doubt a full report will, in due course, be issued by Professor David; meanwhile, I think we should express our pleasure at the safe return of the expedition and our gratification at the success which has so far been achieved, especially as the operations had to be carried out under considerable difficulties.

PROVINCIAL SCIENTIFIC SOCIETIES AND INSTITUTIONS.

Outside the capital of New South Wales scientific societies and institutions are practically non-existent, and I think this is also the case with respect to the other colonies of Australasia, except New Zealand.

New Zealand sets Australia a good example, for although its population is only about one-half that of New South Wales, it has comparatively large and active scientific societies in Auckland, Christchurch, Dunedin, Napier, Nelson, Wellington and Westland. All of these are separate and independent societies, but collectively they form the New Zealand Institute, centered in Wellington. Papers read before the local societies, if of sufficient merit and importance, are published in the Transactions of the New Zealand Institute; this is an exceptionally wise plan, for the smaller societies could not afford the expense of publishing separate annual volumes; further, the papers are distributed more widely and a better standard can be maintained. If there were similar local societies in Bathurst, Broken Hill, Goulburn, Newcastle, and other towns in New South Wales, which are quite as large as some of the New Zealand towns, they could do much for the advancement of science, and assist the aims and objects of this Association.

I have spoken more particularly of this Colony, but of course the remarks also apply to the larger towns of the other colonies, where there are no local societies. Such societies could probably, if they existed and so wished, be affiliated to the Royal Society of New South Wales or of Victoria, South Australia or Queensland, and to this Association. The British Association has a system of corresponding societies, who send delegates to its meetings.

It is a very great pity that such societies do not exist in our provinces, not only for the benefit of the local residents but also for the cause of science generally.

At present this Association has to depend very largely upon the members of the staffs of the universities, observatories, museums, the geological surveys and certain other government departments, and most of these, with the exception of those resident in the

capital in which the session is held, have to undertake a journey of 500 or 600 miles, or even 1,200 miles, as in the case of those who attend from New Zealand, or who, living in Brisbane, attend a meeting in Adelaide, or *vice versa*.

These very long distances are a great disadvantage to the Association, for they mean a considerable expenditure of time and money, and many are thereby debarred from attending. It is largely due to these causes, as well as to the limited number of working members, that we have had most reluctantly to substitute biennial for annual sessions. If we had more working members, and I think we should get them if there were local scientific societies scattered through the Colonies, we should be able to resume our annual meetings, and before very long we ought to be able to hold our sessions in towns like Ballaarat, Bathurst, Bendigo, Goulburn and Newcastle.

For the formation of local societies it is not necessary to start with a large membership—the Royal Society of London began with five or six only.

It is, however, very gratifying, under the circumstances, and with our comparatively limited population, that our meetings are as well attended and successful as they are.

A. Liversidge.

THE RED COLOR OF THE SALT LAKES IN THE WADI NATROUN.

In an article published in the *Zoolog. Anzeiger** I have given a report on the biology of the Natron Valley, the Wadi Natroun, in the Libyan desert, about 170 kilometers from Cairo. It seems that my remarks concerning the red color of the water of the salt lakes of the valley have interested readers of the article. I, therefore, wish to add here some researches I was able to make on the same subject owing to the kindness of Mr. Prochaska, head of the chemical survey of the soda company.

When I came to the Natron Valley the red water of the lakes excited at once my curiosity, and I tried to ascertain the reason for the redness of the liquid. Most people to whom I spoke about the matter told me that *Artemia* lives in the lakes, and that the red color of this Crustacean is communicated to the water. During my stay in the Wadi the *Artemia salina* was not to be seen, the animal appearing only at certain periods of the year. It is impossible to believe that the colored mass of these small creatures is sufficient to stain such immense quantities of water as the Wadi Natroun lakes. These lakes, about fourteen in number, lie rather close to each other and extend over a space of about 40 kilometers. No number of *Artemia salina* would be great enough to give the water the deep purple color which it has. If there were frogs in the lakes and those frogs were red, and some one should say that the red color of the water came from the red color of the Amphibia, this explanation, I think, would not be much inferior to the *Artemia* theory. Besides *Artemia* there are other red animals in the lakes. I obtained, for example, a red culicid larva. This shows that animals living in the water may take the color from it, and not the water from the red animals. Finally, *Artemia salina* disappears in the lakes for the greater part of the year without causing a change in the coloration of the water.

But, if it is not *Artemia salina*, what is it that gives the red color to the water? In my investigations I treated the red water with different chemicals, among them acetic acid. When the acid is poured into the red water a powerful development of carbonic acid takes place, and at the same time a red soft mass rises to the surface of the liquid, while the latter loses more and more of its color. From a large quantity of

* Das Wadi Natroun in der libyschen Wüste und seine niedern Thiere. Bd. 22, p. 53–61, 1899.

water I collected the soft red mass swimming on the surface, washed it with distilled water and shook it in a mixture of ether and absolute alcohol. The red color left the soft mass being extracted by the ether. The solution of the color in ether did not keep the purple tint of the soft mass, but showed a fine brownish coloration, the soft mass itself appearing now as a gray yellowish substance, reminding one of blood fibrine. It could be reduced to ashes and is, therefore, of organic composition. When the lake water was directly exposed to the mixture of ether and alcohol without having passed through acetic acid no result was obtained. Concerning the osmotic property of the red organic mass it is to be noted that it did not pass through a membrane of so-called parchment paper, such as is used for covering jars.

The experiments show that the water of the lakes contains an astonishingly great quantity of organic red substance and that it is this which gives the red color to the water.

The question now arises what the origin of the red organic substance is. My supposition is that the substance must be the product of bacteria. Each drop of water taken from the lakes will be found full of them. The bacteria in all the lakes are uncolored, but I found that the cocci exhibit a red color.

According to 'Baedeker' (Egypt, French edition, 1898) there existed another spot in Egypt, near Suez, where red salt water is found. On page 162 of the guide book I read the following note: "La coleur rouge des marais salants entre des collines des Bédouins et le canal, provient d'une petite écrevisse (de l'ordre des phyllopodes) presque microscopique qui y fourmille à certains moments. Le matin ils exhalent un parfum semblable à celui des violettes." Unfortunately, when I was at Suez I did not visit the 'marais salants,' and I, therefore, wish to call this note to the attention of the biologists visiting that part of Egypt. It would be very interesting to ascertain whether the water there contains bacteria and the same red organic mass which I found in the lakes of the Natroun Valley.

J. DEWITZ.

SCIENTIFIC BOOKS.

Man: Past and Present. By A. H. KEANE. Cambridge Geographical Series. Cambridge, University Press. 1899. 12mo. Pp. 184. Plates 12.

This volume is the sequel to Mr. Keane's 'Ethnology,' which appeared as the first of the series in 1896, and the two must be read together. The author has devoted his life to ethnology, and he has lived for many years in London, surrounded by the best resources of libraries, museums and men. Every authority worth consulting has been within his reach. Mr. Keane is a zealous systematic workman and loves his calling. Let us, therefore, hear what he has to say about man, past and present. The author is an evolutionist who thinks that the genealogy of man is made out. For him the ascent of the Hominidæ is in an independent line from some long-extinct, generalized form, from which the other families of anthropoidia sprung in independent lines. This precursor first appeared in the Indo-Malayan area. Indeed, Dubois's *Pithecanthropus erectus* is assumed as typifying nearly enough the first man.

The time when the precursor became man was in the Pliocene Tertiary, and a million years, more or less, would suffice for all human history. Four sub-species, or varieties of the percursor, were developed in as many separate areas, namely, *Homo Ethiopicus*, *Homo Mongolicus*, *Homo Americanus* and *Homo Caucasicus*.

The centrifugal Pleistocene precursor, erect in posture, but not differing greatly from his nearest ape-like kin in other respects, physical or mental, spread himself over the whole habitable globe. In four separate zones, the four varieties above named were evolved as independently as was the Pleistocene precursor himself. This view has led some to rank the author with the polygenists, but he denies this

and vigorously espouses monogenism. The first chapters are devoted to this generalized man and to the beginning of the historic period. But the bulk of the work treats of the four varieties in detail, and traces with much particularity how each became specialized in its own environment, giving three chapters to *Ethiopicus*, four to *Mongolicus*, two to *Americanus* and three to *Caucasicus*.

I. *Homo Ethiopicus*, developed in two areas, Papuasia and Africa south of the equator. The two sets of peoples, however, are fundamentally one, and the likeness extends to the details of sub-varieties. *Ethiopicus* was the first to branch off from the Pleistocene precursor and develop three sub-varieties. No difficulty is encountered in these early migrations across an Indo-African continent now submerged.

II. *Homo Mongolicus* developed on Central Asian plains and plateaux into three sub-varieties, Mongolo-Tartar, Tibeto-Indo-Chinese and Oceanic Mongols.

III. *Homo Americanus* developed in the New World in Pleistocene times from Indo-Malaysia, whence he came in the primitive state, prior to all cultural developments, by two separate routes, giving rise to two zoological varieties, the Eskimo-Botocudo long-head, who migrated by way of now submerged lands across the North Atlantic; and the Mexican-Andean round-heads, who found their way in the new stone age from eastern Asia by the Bering waters.

IV. *Homo Caucasicus*, whose original home as variety of the Pleistocene precursor was Africa, north of the Soudan, where the Caucasic type was constituted in all its features. He arrived by way of trails across the now submerged Indo-African continent. Thence he occupied the Nile Valley, western Asia, western and central Europe, and worked backward to become Toda in India, Ainu in northeastern Asia, Indonesian in Farther India and Polynesian in the archipelagoes of the Pacific.

Each one of these primitive zoological groups is traced downward, mainly on biological lines to the present ethnic groups. The author has spared no pains in preserving his references in foot notes, thus setting the work away above such general treatises as that of Ratzel. He finds in *Homo Caucasius* the most debatable field, because, he thinks, of the more complex character of the subject. Is it not just possible, however, that our profounder knowledge of this variety makes it more difficult to play the game of synthesis with its parts?

There are three points at which the work could be improved. The publisher has maltreated the author's well selected photographs shamefully. In these days of cheap and excellent graphic processes there is no excuse for this. Some faces are worse than others, but the Toda and the Yezo Ainu, in Plate XII, must have been nearest the cannon cracker when it exploded.

A second weakness also must not be ascribed to the author, for it lies at the door of those who gave him information. For instance, if the members of the National Academy of Sciences agree that Bowers's 'crust,' which was 'busted, falling down a shaft in Calaveras county,' is the cranium of a Pleiocene precursor, Mr. Keane is not to blame for repeating it. Or, if the writer who calls attention to a pair of snow goggles found in a gravel bank at Point Barrow, twenty-six feet beneath the surface, should omit to say that they had been made of driftwood, with a steel knife, and that the same pattern was worn there last winter, who blames Mr. Keane for finding the palæolithic man from the Arctic to Fuegia? Though, we must say that this is the first information of his using snow blinkers.

But, thirdly, the author has marred his book by prejudicial selection of authors. It will certainly grieve some of Mr. Keane's admirers on this side of the Atlantic to find writers quoted seriously who have no standing, while he omits all reference to such distinguished authorities as Daniel G. Brinton, Wm. H. Holmes, Garrick Mallery, Washington Matthews, Charles Rau, Everard M. Thurn and Jeffries Wyman.

O. T. Mason.

The Story of the Mind. By James Mark Baldwin. New York, D. Appleton & Co. Pp. x + 236.

Skill is needed to present psychology in popular form. There is imminent danger of either unreadable technicality or of superficial

chat. Professor Baldwin has escaped both of these and has produced a remarkably good book, which will certainly hold the interest of the lay reader and not forfeit the respect of specialists. The serious-minded who glance superciliously into a book with such a title will probably read far before they lay it down.

The more important departments of the subject are given separate chapters—the mental life of children and of animals, physiological and pathological psychology, social influences, the character of laboratory experiments, and other topics, with a brief introductory view of the general nature of mind and of psychology. The author has not attempted to give the detailed results in these fields, but has chosen some sample problems under the various headings, and stated the case according to our present knowledge. In selecting these he has clearly been guided by his personal interest, taking preferably those topics to which he himself has been an important contributor; and undoubtedly the impression of movement and vitality which the book makes is largely due to the fact that the author is, in a double sense, telling of his own offspring, and can hardly conceal, under his cold and studied phrases, the glow of parental pride. For this reason the various chapters which treat of mental development and the ramifications of the imitative and social instinct are the best parts of the 'story,' and have a swing and security which is scarcely felt in some other portions of the book.

For instance, in the account of the general character of our mental processes, the manner in which the distinction between sensations and their 'apperceptive' connection is treated—the sensations supposedly coming first and from without, while the activity of arranging them springs up later and from within—will help to postpone the good day when all shall acknowledge that sensations are as much an 'inner' affair as is their arrangement or interconnection, and that the 'formal' and 'material' sides of consciousness are but abstractions, both of which are really present in even the simplest mental fact. Consequently they cannot come from different sources nor arrive on the scene at different times. If for popular and pedagogical purposes it seems best to present it otherwise, at least some hint might be dropped so that the wayfaring man who is wise and discriminating need not go astray.

And in the physiological material of the book the reader who is keen for such things might note an objection here and there in the margin. If right-handedness is, as the author admits, but a phase of the wider fact of left-brainedness it seems as infelicitous for him to refer to a 'center for right-handedness' as it would be to speak of a center for right-sideness; it is, as the author says, a matter of the relation of the two sides, and the 'center' consequently would have to include both halves. And if the 'center for right-handedness' becomes later the 'center for speech' the wicked might ask how it is that we do not cease to be right-handed when once we have learned to talk.

In another passage the author refers to very definite anatomical evidence that children have no 'will in any sense' until well along in the first year, for 'the fibers of the brain necessary to voluntary action,' he goes on to say, 'are not yet formed.' In the present state of our knowledge as to just what fibers are necessary for voluntary action this sounds somewhat over-sure; but even though the anatomical connections necessary for the voluntary control of *muscular movements* be wanting, this by no means makes it certain that 'will in any sense' is lacking, seeing that even the laziest interest or listless preference contains the essential of volition, and that the anatomical conditions for such a mental state are not necessarily the same as those for conscious muscular control.

In the chapter on the training of the mind the familiar classification of persons into those of visual, auditory, muscular and other 'types' is given a wider interpretation than the facts will probably allow. Mr. Baldwin seems to assume that a person who is put into the 'motor' class because his mental imagery is predominantly in terms of muscular sensations must also be 'motor' in the sense of preferring to act rather than to reflect, or of being impulsive rather than deliberate. On the contrary, the ordinary imagery-type to which a man belongs does not seem to give us any certain warrant for saying whether he is generally reflective or not, but

only determines which sort of sensation furnishes the common coin of his mental exchange. A person who is motor in this sense may or may not be more impulsive than a good visualizer; it all depends on whether his motor cues habitually bring with them contrary suggestions. Experience seems to show that some of the most hesitating of us act from motor cues, while some of the most impulsive persons are of the 'sensory' and, indeed, of the visual type. We are hardly in a position, therefore, to hold out the hope that the ordinary type-tests will decide whether a boy needs encouragement in precipitateness or in hesitancy. Whether he is too cautious or too headlong is to be settled by observations *ad hoc*, and is not decided by discovering which sense furnishes the stuff of his mental imagery.

But details of this sort to which objections might be raised are not many nor are they so important as to affect the general tone of the book. As a whole it does admirable justice to the more fruitful lines of modern work and will be acceptable to the wide circle of persons who wish some intelligent guidance in psychology, without aiming to be students of it in the stricter sense. Even classes in psychology might well supplement their reading by a fresh narrative like this. And as for the poor schoolteachers, accustomed to their juiceless 'teachers' psychologies,' they will with difficulty believe that a book which is really interesting can be the genuine thing.

G. M. Stratton.

University of California.

How to Know the Ferns. By Frances Theodora Parsons. New York, Charles Scribner's Sons. 1899. 12mo. Pp. 215. Price, $1.50.

When science has its cold matter of-fact angularities concealed by a certain amount of folk-lore, personal adventure and innocent poetical quotation the popular mind takes it in unwittingly without feeling the chilliness of the morsel, and if they are abraded by the angles, there is lubrication and mollification in the dressing that makes one forget the pain. The ordinary unscientific reader is shocked if told at once that an innocent looking fern is a *Cystopteris*, but when he is introduced to it as the 'bulblet bladder-fern' the added syllables cause him no uneasiness and it is quite a different matter. All this softening of the rough angles of a scientific treatise is heightened if attractive illustration furnishes the ready opportunity to save the often tedious work of identification through technical language.

Such a happy combination we have presented in a most attractive form in the book before us. The popular interest is attracted by the personal narratives and one forgets the personal pronouns; one forgets even the rather doubtful compliment paid to the main subject when one reads that 'the greatest charm the ferns possess is that of their surroundings,' a fact emphasized by the frontispiece where the pose of the handsome young woman surely throws 'the cheerful community of polypody' quite into the shade, yet a more attractive picture could scarcely have been chosen.

The work is well written and is really one that can scarcely do otherwise than interest many people who have neither the time nor the mental perseverance for severe study, in one of the most delightful of subjects, and it will certainly bring many into a closer touch with Nature and her productions. The text is in the main very accurate, and the illustrations really illustrate the subject, and do it so well that one must be blind who cannot with their aid identify the ferns of the Northern States. The drawings by Miss Satterlee with less of the impressionist touch appeal more strongly to the cold scientific eye, though all of them are well executed, and the full-page half tones are well chosen and excellent.

While the authoress appears to us under a new name, we recognize in Mrs. Parsons the same writer that a few years ago as Mrs. Dana gave us the equally valuable book, 'How to Know the Wild Flowers.' Armed with these two, many who heretofore have had only guides that were too severe for their summer's outing can be easily and delightfully introduced to the ferns as well as the flowers of the woods and fields.

L. M. Underwood.

BOOKS RECEIVED.

Principes d' hygiène coloniale. Georges Treille. Paris, Carré and C. Naud. 1899. Pp. 272.

Laboratory Manual Experiments to illustrate the Elementary Principles of Chemistry. W. W. HILLYER. New York and London, The Macmillan Company. 1899. Pp. 198.

A Short History of the Progress of Scientific Chemistry in Our Own Times. WILLIAM A. TILDEN. Longmans, Green & Co. 1899. Pp. x + 276.

SCIENTIFIC JOURNALS AND ARTICLES.

American Chemical Journal, July, 1899: 'Camphoric Acid,' by W. A. Noyes; 'Contributions to our Knowledge of Aqueous Solutions of Double Salts,' by H. C. Jones and K. Ota. This is a continuation of the investigation of the double sulphates. The evidence, in the case of the double chlorides, seems even stronger in favor of the hypothesis which has been so strongly emphasized by Remsen, that double salts are true compounds, as this work shows that molecules of double salts exist as such in concentrated solution. 'On Undecylamine and Pentadecylamine and the Preparation of the Higher Amines of the Aliphatic Series,' by Elizabeth Jeffreys; 'An Electric Drying Oven,' by T. W. Richards. The general devices that can be used to secure the desired results in a drying oven are shown when the source of heat is due to electrical resistance. 'On Certain Derivations of Symmetrical Trichlorbenzol,' by C. L. Jackson and F. H. Gazzolo; 'Narcotine and Narceine,' by G. B. Frankforter and F. H. Keller; 'The Reaction between Aliphatic Sulphocyanates and Metallic Derivatives of Acetoaceticester and Analogous Substances,' by E. P. Kohler; 'A Method for Carrying out Chemical Reactions under High Pressures,' by B. H. Hite. The author gives full details for the apparatus necessary for such work.

J. ELLIOTT GILPIN.

THE *Mois Scientifique et Industrielle* is the title of a new monthly journal which has begun publication in Paris. Each number contains an original article and a digest of physical and chemical literature. The subjects covered are physics, including electricity and applications; chemistry and the chemical industries, including metallurgy, dyeing, distilling, sugar making, etc.; the mineral industries; mechanics and the mechanical industries, and agriculture.

SOCIETIES AND ACADEMIES.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE following titles of papers submitted for the Columbus meeting have been received by the secretaries of the respective sections. Additions will doubtless be made to the programs at the time of the meetings.

SECTION B—PHYSICS.

On a new spectrophotometer and spectroscope; On achromatic polarization in combinations of crystalline media: D. B. Brace, University of Nebraska, Lincoln, Nebr.

An apparatus for the demonstration of the varying currents in the different conductors of a rotary converter: F. C. Caldwell, Ohio State University, Columbus, O.

On optical calibration of the slit of a spectrophotometer; Absorption spectra of solutions: E. V. Capps, University of Nebraska, Lincoln, Nebr.

An absolute determination of the E. M. F. of the Clark cell: Henry S. Carhart and Karl E. Guthe, University of Michigan, Ann Arbor, Mich.

The time of perception as a measure of the intensity of light; Relation between space and time in vision: J. McK. Cattell, Columbia University, N. Y.

On the fluting in Kundt's tubes with gases at different pressure; On the escape of gases from planets according to the kinetic theory: S. R. Cook, University of Nebraska, Lincoln, Nebr.

Note on hysteresis curves determined by a yoke with broken magnetic circuit; On the demagnetizing effect of currents in iron when electro-magnetically compensated: Z. E. Crook, University of Nebraska, Lincoln, Nebr.

A new graphical method of constructing the entropy-temperature diagram from the indicator card of a gas or oil engine: H. T. Eddy, University of Minnesota, Minneapolis, Minn.

Some types of March weather in the United States: Oliver L. Fassig, Johns Hopkins University, Baltimore, Md.

Magnetic measuring instruments and the laws of magnetism; some new electric apparatus; wave forms in the aluminum condenser

cell and in the magnetically blown arc; Method of locating point of discharge of smokeless powder by colored screens: Reginald A. Fessenden, Western University of Pennsylvania, Allegheny, Pa.

Polarization and polarization capacity: Karl E. Guthe and A. D. Atkins, University of Michigan, Ann Arbor, Mich.

Accidental double refraction in colloids and crystalloids: B. V. Hill, University of Nebraska, Lincoln, Nebr.

A method for the study of phosphorescent sulphides: Fred. E. Kester, Ohio State University, Columbus, O.

Simple science work for common schools: H B. Mathews, Agricultural College of South Dakota, Brookings, S. D.

Pressure and wave-length: John Fred Mohler, Dickinson College, Carlisle, Pa.

On the effect of concentration series in the copper voltameter: B. E. Moore, University of Nebraska, Lincoln, Nebr.

On the coincidence of the two refracted rays in biaxial crystals: L. T. More, University of Nebraska, Lincoln, Nebr.

Thorium radiations: R. B. Owens, McGill University.

On differential dispersion in double refracting media: E. J. Rendtorff, University of Nebraska, Lincoln, Nebr.

A new voltage regulator: Geo. D. Shepardson, Granville, O.

The relation between magnetism and the elasticity of rods—and some S. H. M. curves: James S. Stevens, University of Maine, Orono, Me.

Note on the preparation of photographic reticles: David P. Todd, Observatory House, Amherst, Mass.

The equipment and facilities of the office of the U. S. standard weights and measures for the verification of electrical standards and measuring apparatus; An experimental test of the accuracy of Ohm's law: Frank A. Wolfe, Jr., U. S. Coast and Geodetic Survey, Washington, D. C.

SECTION F—ZOOLOGY.

Æstivation of *Epiphragmorphora traskii* (*Newcomb*) in S. California: M. Burton Williamson, Los Angeles, Cal.

Natural taxonomy of the class *Aves*: R. W. Shufeldt, Takoma Park, D. C.

Notes on the morphology of the chick's brain: Susanna P. Gage, Ithaca, N. Y.

Further notes on the brook lamprey (*Lampetra wilderi*): Simon H. Gage, Cornell University, Ithaca, N. Y.

Respiration in tadpoles of the toad (*Bufo lentiginosus*): Simon H. Gage.

Photographing natural history specimens under water or other liquids with a vertical camera: Simon H. Gage.

Hybrid butterflies of the genus *Basilarchia*: William L. W. Field, Milton, Mass.

On some piratine bugs which may be responsible for so-called 'spider-bite' cases: L. O. Howard, Department of Agriculture, Washington, D. C.

Observations on the development of mammals: Charles S. Minot, Harvard University, Cambridge, Mass.

The correct systematic position of the *Spongidæ* in Zoology: W. R. Head, Chicago, Ill.

Have we more than a single species of *Blissus* in North America? F. M. Webster, Wooster, Ohio.

On the utility of phosphorescence in deep-sea animals: C. C. Nutting, University of Iowa, Iowa City, Ia.

On the criteria for interpreting the psychology of animals: C. C. Nutting.

A discussion of *Aspidiotus cydoniæ* and its allies: C. L. Marlatt, Washington, D. C.

Temperature control of scale insects: C. L. Marlatt.

SECTION I—SOCIAL AND ECONOMIC SCIENCE.

The psychological value of statistics: Carroll D. Wright, Washington, D. C.

[Title to be announced]: Edmund J. James, Chicago University.

Some new aspects of educational thought: Thomas M. Balliet, Springfield, Mass.

The basis of war and peace: M. A. Clancy, Washington, D. C.

Business cooperation: N. O. Nelson, St. Louis, Mo.

Thoughts on education from the standpoint of Porto Rico: John Eaton, Washington, D. C.

Some thermal determinations in the heat-

ing and ventilating of buildings: Gilbert B. Morrison, Kansas City, Mo.

Science and art in social development: John S. Clark, Boston, Mass.

Moral tendencies of existing social conditions: Washington Gladden, Columbus, O.

The manual element in education: C. M. Woodward, St. Louis, Mo.

[Title to be announced.]: W. B. Powell, Washington, D. C.

Natural distribution, as modified by modern agriculture: John Hyde, Washington, D. C.

Calculations of population in June, 1900: Henry Farquhar, Washington, D. C.

Civil Service in the United States: H. T. Newcomb, Washington, D. C.

Federal guaranties for maintaining republican government in the States: Cora A. Benneson, Cambridge, Mass.

DISCUSSION AND CORRESPONDENCE.

ON THE U. S. NAVAL OBSERVATORY.

THE article on the U. S. Naval Observatory by Professor Asaph Hall, Jr., in the number of SCIENCE for July 14th, treats very effectively of some matters which astronomers have long wished to see altered at that institution. Many able line officers—D. D. Porter and others—have served there, as Professor Hall suggests. Any amount of such service, however, can no more make astronomers than the service of half-pay officers could do in Sir George Airy's time, although at either Washington or Greenwich the habit of naval discipline was a help toward the formation of careful habits of observation. Nor do I suppose that the earlier Greenwich assistants, Baldrey and others, were better astronomers at the start than those at Washington, who brought with them a knowledge of astronomy.

In general we should find in the earlier volumes of the Washington observations precisely what we might expect if we knew the history of the establishment derived from the accessible data beginning with Gilliss's first report, which contains, among other things, the description of the instruments procured, some of them antiquated when they were constructed, others still used to some extent, others now replaced by haphazard constructions for which some one more or less acquainted with the matter is responsible.

In general it may be said that the success or failure of the observatory now in use will be more definitely decided in two or three years after it is better known what the later reports shall indicate as to the constructive ability of the mechanicians who have been employed to replace or remodel the work of Troughton and Simms, Pistor and Martins, Alvan G. Clark and the other makers at first selected.

There is no doubt, I imagine, that the present astronomers at the observatory have had nearly *carte blanche* to do what they would, and we shall learn in a few years whether the immense amount of money expended on it has produced proportionate results, or is likely to appear to do so when they come forth to view. The excuses which were for several years offered for the delay in actually beginning the work on the zone—14° to—18° were not altogether satisfactory, as the astronomer whose observations of it are so quickly accomplished had been many years in service, and there is, so far as I am aware, nothing to show the necessity of the delay, except, if I may speak plainly, the entirely haphazard manner in which the U. S. Naval Observatory had been conducted from 1845 to the actual time of beginning observations on the zone.

It is not, in my judgment, necessary to do more to greatly improve the institution than to follow Airy's example in a simple matter of business according to the general custom at great observatories of the present day.

The appointment of a strong and intelligent visiting committee, to include a few prominent officers of the army and navy, together with a number of eminent and intelligent civilians, would add greatly, almost without expense or trouble, to the definiteness of the plans and the steadiness of the execution of the work of the institution, as one can readily see from the late autobiography of Sir George Airy.

TRUMAN HENRY SAFFORD.
WILLIAMS COLLEGE OBSERVATORY, July 19, 1899.

CEREBRAL LIGHT.

DR. E. W. SCRIPTURE, in SCIENCE of June 16th, gives an account of an experiment which

he holds proves that the so-called 'retinal light' is really 'cerebral light.' The experiment which he considers conclusive consisted in looking at a dimly lighted window in a dark room, the window being so dimly lighted that both the retinal figures and the window could be seen. He then moves the eyeballs with the fingers and notices that the retinal figures are stationary, while the image of the window moves. Dr. Scripture apparently confuses movement of the retina and movement on the retina. What he calls movement in the case of the image of the window is evidently movement of the image on the retina as shown by the 'local signs' of the retina. But the retinal figures, being impressed on the retina, move with it and not on it, and therefore the local signs of the retina give no evidence of its movement.

In repeating the experiment I gazed fixedly at the window for some time. In closing my eyes I had impressed on the retina, in addition to the retinal figures, a faint after-image of the window. If the eyes were now moved, as Dr. Scripture directs, no movement was noticeable in the after-image. It did not separate into two moving images, for this would necessitate a change in position of the two images in relation to corresponding points of the two retinas. If two dissimilar after-images are impressed, one on each retina, and the eyeballs pressed, they, for the same reason, will show no relative motion. Why, then, should we not expect the retinal figures to remain single and immovable, as Dr. Scripture found them to be?

E. B. Wheeler.
Missouri State University, July 24, 1899.

NOTES ON INORGANIC CHEMISTRY.

Two reports have recently been presented to the Home Office in Great Britain which are of considerable general interest, one on the use of yellow phosphorus in matches, and the other on the use of lead in pottery glazes. The first of these reports is by a commission consisting of Professors T. E. Thorpe, S. Oliver and Dr. Cunningham, and the other by Professors Thorpe and Oliver, and both have been reviewed at some length in *Nature*. Only two kinds of matches seem to be considered, the 'strike anywhere,' which is tipped with yellow phosphorus, and the 'safety,' in which red phosphorus is used, and is not on the match, but on the striking surface of the container. According to the report no danger seems to attend the manufacture where red phosphorus is used. In the case of yellow phosphorus, the dangerous processes are mixing the paste, dipping the matches, drying and boxing, this last involving the most handling. Already existing rules in Great Britain require efficient ventilation, non-employment of laborers who have suffered with necrosis or have lost a tooth, immediate medical examination of persons suffering with toothache, notification of cases of necrosis, and proper washing conveniences. The immediate question before the commission was as to whether they should recommend the prohibition of yellow phosphorus. In view of the competition of other countries, notably Belgium, Sweden and Japan, for export trade, and, as it has been shown that proper precautions can prevent danger in manufacture, it was felt wise not to prohibit the use of yellow phosphorus, unless an international agreement could be reached. They suggest, however, more precautions, and point to the Diamond Company, of Liverpool, where no cases of phosphorus necrosis have ever occurred. Unless we are mistaken, not a few of the American manufacturers have solved successfully the problem of tipping the match itself with a paste of amorphous phosphorus, while the use of the 'safety matches' is, happily, rapidly increasing.

The report on lead glazes is more far-reaching in its recommendations, but, according to W. Burton, in *Nature*, is hardly practical. The recommendations are as follows: (1) Prohibition of lead glazes in seven-tenths of the wares produced in the potteries; (2) That in the other three-tenths lead should be used only in the form of a lead silicate frit; (3) The use of lead white in glazes or colors absolutely prohibited; (4) Prohibition of women and children in all processes where they would come in contact with the lead work. Mr. Burton would agree to the second and third recommendations, but considers the first and last impracticable, on account of the difficulty of replacing lead glazes by leadless glazes for many wares, and on ac-

count of foreign competition. He points out the vast difference between laboratory experiments and practical pottery, especially with reference to leadless glazes. He believes that the adoption of the second and third recommendations, together with monthly medical inspection of *all* workers, would put an end to the evils of plumbism.

THE *Zeitschrift für angewandte Chemie* gives an account of a recent explosion in a Swiss school in connection with experimentation on oxygen. The oxygen was contained in a glass gasometer, which had been previously completely filled with water, and had been generated from potassium chlorate. Unknown to the teacher, the gasometer had earlier been used for acetylene and the water had not been renewed. It seems probable that sufficient acetylene had been dissolved by the water to give an explosive mixture with the oxygen.

IN the *Philosophical Magazine* for June, Gerald Stoney gives an interesting comparison of the amount of oxygen in the atmosphere and in the exterior of the earth. Above a square centimeter of the earth's surface are 234.5 grams oxygen. The same amount would be contained in a column of water of the same section and 264 centimeters deep, and in a still shallower column of the earth. Considering the earth's 'crust' to be of approximately constant composition to a depth of seventeen miles, the amount of oxygen in it would be more than ten thousand times as great as that in the atmosphere.

AT the recent Royal Society's Conversazione, Sir Wm. Crookes exhibited photographs of lines high in the ultra violet region, characteristic of a new element associated with yttrium and separated from it by long fractionation. The element has an atomic weight, probably near 117, and its oxid in the purest state yet prepared is of a pale brown color. The name of *victorium* has been given to the element.

NOTE was recently made of the investigations of Parmentier, tending to show that fluorin is not present in certain mineral waters, as had been previously held. In a succeeding number of the *Comptes Rendus* Charles Lepierre maintains that minute traces of fluorin have been detected in many mineral waters, and no less than ten or twelve milligrams per litre are present in the Gerez water (north Portugal). This water is considered very efficacious in liver diseases.

A PAPER was recently read before the Royal Society by David Gill on the presence of oxygen in the atmosphere of certain fixed stars. A study of the spectrum of δ *Crucis* reveals the presence of all the stronger oxygen lines as well as all the known helium lines. On the other hand, no trace of true nitrogen lines are found in the spectrum. Hydrogen is present, and probably carbon and magnesium. The spectra of δ and ϵ *Canis Majoris* and probably δ *Centauri* are practically identical with that of *Crucis*.

J. L. H.

CANNIBALISM IN QUEENSLAND.

EUGENE F. RUDDER contributes to a recent number of *Science of Man* (Vol. 2, No. 3, Sydney, April 21, 1899) interesting personal observations on the Blackfellows of Queensland. Accidentally he stumbled on a silent but apparently ceremonial feast on the flesh of 'a very powerful, well-conditioned black,' who had been shot in an attempt to escape from capture for some offense the day before. The skin had been removed entire and was drying before the fire on five spears set in the ground; and, on detection, the group of blacks deserted their work and did not reappear. Inquiry among other blacks yielded little connected information concerning the case, except that 'It make 'im blackfellow strong fellow'; but more general inquiries elicited the information that the anthropophagy was commonly limited to the bodies of those killed in battle or by accident, and that the feast was ceremonial and usually limited to the kinfolk of the deceased. In one case a girl was speared and eaten by two rivals for her hand; the body was cooked on a sort of platform of green poles, laid above the glowing coals of a large fire when nearly burned down. Another case was the killing and eating of a female child by the mother; this is said to be an established custom in case of excess of female children, or in case of deformity, the custom being enforced by capital punishment, and the

belief underlying the custom being the characteristic notion that the powers of the consumed are thereby conveyed to the consumer. A related belief finds expression among the same people in the practice of opening the abdomen of an enemy killed in battle, extracting the caul fat and annointing with it the body of the victor, the ceremony taking place while the body of the victim is still warm, or, if practicable, before his death. In all cases, of anthropophagy the skins were carefully removed, dried, and then hung in high trees to be blown about by the winds.

W J M.

PROPOSED INSCRIPTION FOR THE STATUE OF DARWIN.

We recently quoted from the London *Academy* inscriptions proposed for the statue of Darwin. Mr. Edward Montgomery, of Hemstead, Texas, suggests the following substitute:

Charles Darwin, whose painstaking biological investigation has demonstrated the developmental ascent of lowest to highest forms of life, proving Evolution to be the master-key to the secrets of nature, and opening to striving humanity the inspiring prospect of natural perfectibility.

We have also received from 'Milner Kenne' the following sonnet:

CHARLES DARWIN.

Father of Science, versed in Nature's lore,
  Toilsome unraveller of her mystic laws,
  Tracing by painful thought effect to cause
Till, like Columbus, thou new worlds explore;
Say, shall we ever see thy equal more?
  Modest as great, yet fearless without pause,
  Careless alike of censure or applause,
Steering still onward to the unknown shore.

To thy keen sight, thy patient thought and clear,
  The newer science owes nativity.
Thy sunlike mind bids ignorance disappear
  Till Nature's wonders seem to mirror thee,
And to us mourning say in words of cheer,
  Si monumentum quaeris, aspice!

THE NATIONAL ZOOLOGICAL PARK.

The following circular letter has been sent by the Secretary of the Smithsonian Institution to officers of the army serving in the Philippines, Cuba, Porto Rico and Hawaii and on other outside stations:

The Secretary, on behalf of the Regents of the Smithsonian Institution, and with the permission of the Honorable the Secretaries of State, of War and of the Navy, calls the attention of officers of the United States on foreign stations to the fact that there is at the capital a National Zoological Park, established by an Act of Congress approved April 30, 1890, which provides:

That the National Zoological Park is hereby placed under the direction of the Regents of the Smithsonian Institution, who are authorized to transfer to it any living specimens, whether of animals or plants now or hereafter in their charge; to accept gifts for the Park at their discretion, in the name of the United States; to make exchanges of specimens, and to administer the said Zoological Park for the advancement of science and the instruction and recreation of the people.

That the heads of the executive departments of the government are hereby authorized and directed to cause to be rendered all necessary and practicable aid to the said Regents in the acquisition of collections for the Zoological Park.

This Park, of which some idea may be formed by the accompanying map and illustrations, has been established in an unusually beautiful site near the city of Washington. It is intended to form here a representative national collection which, while especially rich in our native American animals, shall also contain specimens from all parts of the world, and shall be to America what the zoological gardens at London, Paris and Berlin are to their respective countries.

For several years Congress made no appropriation for the purchase of animals, and the Park is still largely dependent upon gifts to increase the collection, which is far from adequate as an exhibit in a national institution.

If officers stationed abroad who may be interested in animal life would bear in mind the necessities of the Park many additions could be made to the collection. Almost any foreign animals would be gladly received.

Expenses of boxing and of land transportations, where necessary, will always be paid by the Zoological Park.

Purchase of animals can be made only in exceptional cases, but if the opportunity for any especially desirable acquisition arises the Secre-

tary of the Smithsonian Institution would be pleased to be advised by letter or, in urgent cases, by telegraph. The Secretary would also be glad to correspond with officers who expect to visit regions where interesting animals occur.

Public recognition of gifts is made, the names of donors being placed upon the labels attached to the cages or pens, and a notice of the gifts, with the names of the donors, is also made a part of the annual report of the Secretary of the Smithsonian Institution.

A list of the most important animals that can be collected in different countries is appended hereto, and concise directions for boxing, shipping and feeding are given.

SCIENTIFIC NOTES AND NEWS.

A CABLEGRAM from Cairo dated July 27th states that Mr. N. R. Harrington, instructor in Western Reserve University, has died at Atabara of typhoid fever. Mr. Harrington was a member of the Senff zoological expedition of Columbia University, which was on its way to the upper Nile for the purpose of studying the embryology of *Polypterus*.

REPORTS from the *Elder*, carrying the party of men of science taken to Alaska by Mr. E. H. Harriman, state that the trip has been in every way successful. The steamship is now returning from Kodiak to Sitka.

MAJOR MARCHAND is to be presented with the grand gold medal of the French Geographical Society for 1900. Silver replicas will be given to all the officers of his mission. Major Marchand has been appointed to the 4th Regiment of Marines and his subordinates have also been reincorporated in the army.

MR. H. N. DICKSON, of New College, Oxford, has been given the Johnson Memorial Prize of the University for his work on 'The Currents in the North Sea.'

DR. E. A. DE SCHWEINITZ, Director of the Bio-chemic Laboratory of the U. S. Department of Agriculture and Dean of the Columbian Medical School, Washington, and Dr. R. de Schweinitz, professor of ophthalmology, of Jefferson Medical College, Philadelphia, attended a meeting of the Paris Academy of Medicine on June 12th.

DR. E. PFLÜGER, professor of physiology at Bonn, well known for his physiological researches and as editor of the *Archiv für die gesammte Physiologie*, commonly known as Pflüger's Archiv, recently celebrated his 70th birthday.

DR. V. VON LANG, professor of physics in the University of Vienna, has been elected General Secretary of the Vienna Academy of Sciences.

THE Linnæan Society of London has elected the following foreign members: M. Adrien Franchet, of Paris; Dr. E. C. Hansen, of Copenhagen; Professor Seiichiro Ikeno, of the University of Tokyo; Dr. Eduard von Martens, of the University of Berlin, and Professor G. O. Sars, of the University of Christiania.

THE Liverpool Section of the Society of Chemical Industry proposes to collect £300 for the establishment of a lectureship to commemorate the services to applied chemistry of the late Dr. Ferdinand Hurter.

THE Right Rev. Charles Graves, F.R.S., Lord Bishop of Limerick, has died at the age of 87 years. He was formerly professor of pure mathematics at Trinity College, Durham, and has made many contributions to mathematics.

THE *American Anthropologist* publishes an obituary notice, by Mr. A. R. Spofford, of Mr. Manning F. Force, who died at Sandusky, Ohio, on May 8th, at the age of 75. He was one of comparatively few Americans who, while engaged in other pursuits—he was a Judge in the Superior Court—took an interest in science and contributed to its advancement. His work on the Mound-Builders of the West is a standard authority on this subject.

THE annual meeting of the corporation of the Marine Biological Laboratory will be held at the laboratory at Woods Holl, Mass., on Tuesday, August 8, 1899, at 12 o'clock, noon, for the election of officers and trustees, to act on an alteration of the by-laws and to transact such other business as may come before it.

AN International Hydrographic and Biological Congress for the discussion of the conditions of the North Sea and North Atlantic Ocean met at Stockholm on June 16th.

THE German Anthropological Society and

the Anthropological Society of Vienna will meet together at Lindau on September 4th.

At the International Congress of Zoology, which is to be held in 1901 at a place in Germany yet to be determined, the prize founded by the Czar of Russia will be awarded for the third time. The subjects proposed are: 'Influence of light in the development of colors in Lepidoptera: the causes determining the differences of color, form and structure of parts covered during the resting position in insects.' The papers may be either printed or in manuscript. There are two conditions, the grounds for which it seems somewhat difficult to understand. The papers must be written in French, and those living in the country in which the Congress is held may not compete.

Messrs. Warner & Swasey, of Cleveland, the well-known telescope makers, have presented to Western Reserve University a telescope and dome and other astronomical apparatus. The telescope is a ten-inch instrument. Of its size it will probably be the best which Warner & Swasey have made. The telescope and dome will be placed on the tower of the Physical Laboratory, and will be erected, probably, early in September. Frank P. Whitman, professor of astronomy and physics, is the successor of the late Professor Elias Loomis, of Yale University, and Professor Charles A. Young, now of Princeton University.

The National Museum, through the Bureau of American Ethnology, has just received from California the entire Hudson collection of Indian basket work. This fine collection is one which never can be duplicated, as basket making is already a dying art among the Indians. The Hudson collection numbers about 325 pieces, of which many would sell at $100 or more each in San Francisco. It was made by Dr. J. W. Hudson during about twenty years' intimate association with the Pomo and other Pacific coast tribes. Many of the specimens are sacrificial baskets, which are made with great labor, and are seldom obtained by collectors, being burned on the death of their owners. Foreign institutions have sought to secure this collection, but failed. Professor McGee, of the Bureau, and Professor Holmes, of the Museum, obtained an option on it last year. The price to the National Museum was almost nominal, by reason of Dr. Hudson's desire to have the collection remain in this country.

The *Electrical World* states that but few of the priceless relics associated with the name of Volta were saved from the buildings of the Volta Centenary Exposition destroyed at Como, on July 8th. Among the articles saved was one of Volta's early piles, about twenty manuscripts, a few of his letters and a few books that had belonged to his library. An irreparable loss was that of his laboratory notes and scientific correspondence. In the accounts of the destruction of relics the first electrophorus and first absolute electrometer are not mentioned among the articles saved. Among other losses were a number of Ferraris's models and some of his manuscripts and diplomas. Among the former was the first model of the rotary field. This is presumably the same that in 1893 was forwarded to the Chicago Exposition by a vessel which was sunk in the harbor of Genoa, but subsequently raised and the model recovered and sent to Chicago, where it was exhibited.

A preliminary report, says *Natural Science*, upon the results of the scientific expedition to the island of Socotra has been issued by Mr. Henry O. Forbes, Director of Museums to the Liverpool corporation, who, under the auspices of the Royal and Royal Geographical Societies of London, and of the British Association, and in conjunction with Mr. W. R. Ogilvie Grant, representing the British Museum, undertook the investigation of the natural history of the island. The expedition occupied a period of about six months, and the investigations were conducted amid considerable difficulties. At one time all the members of the party were laid down by a pernicious form of malaria, and they also suffered from frequent attacks of fever. The party was fortunate in discovering many new species of plants and animals, and a valuable collection has been brought home. According to the report the Socotrians are only poorly civilized Mahommedans, living in caves or rude cyclopean huts, and possessing but few

utensils, implements or ornaments, and no weapons. The ethnographical collection is consequently small. The plant specimens have been handed to a well-known student of the flora of Socotra, Professor I. Bailey Balfour, of Edinburgh University, who describes them as of high scientific interest and of great commercial value. The cultivation of some of them is being undertaken in the Royal Botanic Garden at Edinburgh. The report concludes by congratulating Liverpool on being the first provincial corporation to further the advancement and increase of knowledge by actively sharing in the investigation of unknown regions.

THE *Auk* reports the return of Mr. George K. Cherrie from his expedition to Venezuela, where he spent twenty-one months collecting for the Tring Museum. His field was the Valley of the Orinoco, from Ciudad Bolivar to the Ventuari River, above the falls and beyond San Fernando de Atabapo. He devoted his time almost exclusively to birds, but collected some insects and small mammals. Many nests and sets of eggs were forwarded with the birds. He reports that collecting between Ciudad Bolivar and the first falls of the Orinoco was rather disappointing and monotonous; while individuals were abundant the species were surprisingly few. Above the falls the fauna changed rapidly; the number of species increased, and with every move up the river new forms appeared. Fly-catchers, Wood-hewers and Ant-thrushes were the dominant forms, while there was a striking scarcity of Humming-birds. Mr. Cherrie'e work was cut short by serious illness, which compelled his withdrawal from the country with his work only begun.

IN reply to a recent letter from the Liverpool School of Tropical Diseases in regard to the prospective research expedition to West Africa the Colonial Office write, according to the London *Times*, that "Mr. Chamberlain had learned with great satisfaction that the expedition of the Liverpool School is being sent, and appreciates the energy and public spirit shown by the Committee of the School in the matter. The authorities at Sierra Leone will be instructed to give every facility to the work of the expedition." The Colonial Office have also sent for the use of the School valuable medical and sanitary reports of various tropical colonies, and the India Office have sent their medical publications. The British Museum directors have been invited to send with the expedition their dipterologist, Mr. E. E. Austen, offering to pay his expenses. The expedition is expected to throw an important light on the theory held by Major Ross and others as to the propagation of malaria by mosquitoes. The expedition was to start on July 29th and proceed direct to Sierra Leone, and will set to work at once in a district which then happens to be peculiarly unhealthy. It is intended afterwards to make investigations at Accra. The Belgian government have sent an officially-appointed delegate, Dr. S. Van Neck, to visit the Liverpool School of Tropical Diseases and accompany the expedition.

Natural Science states that the Indian Marine Service steamer, the *Investigator*, has recently closed a season of surveying, with important results both for navigation and zoology. The *Investigator*, starting from the Moulmein River, in Burma, last January, steadily surveyed—and her surgeon-naturalist, Captain Anderson, trawled—across the bay to the northern end of the great Andaman, and fixed the position of the island for the first time. Thence the longitudinal position of Port Blair, the capital of the penal settlement of the government of India, was fixed by running a meridian distance to Double Island, off Burma. When at work in the Middle Straits, between the two largest islands, the ship's staff had the assistance of forty tamed Adamanese pigmies against their as yet savage countrymen, who of late have killed several of the Indian convicts near Port Blair with poisoned arrows. The fifteen islands in the three groups of the Cocos, four Andamans and nine Nicobars, will henceforth be a help instead of a danger to the busy mercantile marine plying between Calcutta, Madras, Burma and the Straits Settlements. The deep sea trawl went down in some cases from 480 to 800 fathoms, from which Dr. Anderson brought up not a few valuable additions to his collections.

THE Seine below Paris is now free from sew-

age. A law of July 10, 1894, allowed five years for this operation, and it has been punctually accomplished with two days to spare. The great collector at Clichy has been closed, and henceforth half a million cubic meters of sewage daily will, instead of being discharged into the Seine, find an outlet at Achéres, Méry and Gennevilliers, to be spread over 3,500 hectares of land.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Ahearn bill, passed by the recent New York Legislature, allows $96,000 to be spent on free lectures next year in New York City, being an increase of $36,000 over last year. The lectures are largely on scientific topics and are doing much for the education of the people.

WE learn from *Natural Science* that the colonies of the west coast of Africa have adopted a scheme whereby picked boys shall be sent for training in horticulture and economic agriculture, first to Jamaica and afterwards to Kew Gardens. This scheme is due to the success that attended the experiment initiated by the then Governor, Sir A. Maloney, of sending in 1890 two native lads from Lagos to be trained as gardeners at the Jamaica and Kew Gardens. After spending two years and a half in Jamaica they were attached to Kew Gardens for some months, and are now in charge of branch botanic stations in Lagos, growing and preparing agricultural products and giving instruction.

DR. W. WACE CARLIER, in the University of Edinburgh, has been appointed professor of physiology in Mason University College, Birmingham.

DR. ADELBERT VON WALDENHOFEN, professor of applied electricity at the Vienna School of Technology, has retired, after more than fifty years of service.

PROFESSOR A. WILMER DUFF, now of Purdue University, Lafayette, Ind., has accepted the professorship of physics in the Polytechnic Institute, Worcester. Professor Duff received his B. A. degree in 1884 in New Brunswick, after which he went to Europe for advanced study in the University of Edinburgh. Here he studied with the distinguished physicist, Professor Tait, and in 1888 received the master's degree, with first-class honors, in mathematics and mathematical physics, receiving also a fellowship in physics. In 1888 and 1892 Professor Duff studied in Berlin, having, in 1889 and 1890 filled temporarily the professorship of physics in Madras, India. Since 1893 he has filled the chair in physics at Purdue University with great success. He is a fellow o the American Association for the Advancement of Science, and has made a number of important investigations in physics which have been published in the *Philosophical Magazine*, the *Physical Review* and other leading scientific journals. At present he is engaged on some researches on sound, of great scientific and practical importance.

PROFESSOR A. W. FRENCH, formerly of the Thayer School of Civil Engineering, Dartmouth College, has been appointed professor of civil engineering in the Worcester Polytechnic Institute. Professor French was educated at Dartmouth College and at the Thayer School of Civil Engineering, from which he received the degree of C.E. in 1892. The Thayer School is well known to be of the first rank in the United States as a graduate school of civil engineering. Its courses are probably more exacting and extensive than those of any other institution. After his graduation Professor French spent two or three years in practice, serving as assistant engineer to Tower Brothers, of Holyoke, and as engineer in charge of the Platte River Paper Mills. Subsequently he was engineer in charge of the Denver and Platte Pumping Station, and this was followed by an appointment as assistant engineer on the Denver and Gulf Railway, especially in bridge designing. In July, 1895, he was called to an associate professorship in the Thayer School, from which he was graduated. He filled this chair most acceptably to the Director, Dr. Robert Fletcher, until 1897, when he resigned for the purpose of again taking up the practice of his profession with the object of obtaining a more varied experience in actual field and construction work. During the past two years he has been the principal engineer of the Niagara Engineering Works, Niagara Falls, New York, which position he leaves to come to Worcester.